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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/552,857	02/08/2006	German Spangenberg	FREE.P-007	4572
57381	7590	02/18/2010		
Larson & Anderson, LLC			EXAMINER	
P.O. BOX 4928			KUBELIK, ANNE R	
DILLON, CO 80435				
			ART UNIT	PAPER NUMBER
			1638	
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			02/18/2010	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

# Office Action Summary

**Application No.**

10/552,857

**Applicant(s)**

SPANGENBERG ET AL.

**Examiner**

Anne R. Kubelik

**Art Unit**

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 10/13/09.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 62-76 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 62-76 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 October 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-8508)
- Paper No(s)/Mail Date \_\_\_\_\_

- 4) ☐ Interview Summary (PTO-413)
- Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

### DETAILED ACTION

1. Applicant's election with traverse of group II (SEQ ID NOs: 2 and 10 and optionally SEQ ID NO:14) in the reply filed on 13 October 2009 is acknowledged.

The traversal is on the ground that the claims do not recite variants; the claims state that the construct has nucleic acid portions from *Trifolium* species.

This is not found persuasive because claims 65-69 do not require a nucleic acid from a *Trifolium* species.

The traversal is also on the ground that Suzuki related to a different genus, which have less than 65% identity at the nucleic acid level; and claim 65 requires 90% identity to the starting sequence, which Suzuki does not disclose.

This is not found persuasive because claim 65 does not require 90% identity to the starting sequence; the claim requires a fragment or variant having at least 90% identity to "the relevant part" of the starting sequence. While it is not clear what "the relevant part" is, claim 67 indicates that 60 nucleotide fragments are encompassed; thus, even smaller fragments are encompassed in claim 65, including dinucleotides. Suzuki teaches sequences that have at least a portion that is 90% identity to at least a portion ("the relevant part") the starting sequence.

The requirement is still deemed proper and is therefore made FINAL.

2. The listing of references in the specification is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609.04(a) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless

the references have been cited by the examiner on form PTO-892 or by Applicant on an IDS, they have not been considered.

***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 62-76 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter that was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The essential features of the claims 62-64 and 69-76 are nucleic acids encoding a chalone synthase, dihydroflavonal 4-reductase and/or leucoanthocyanidine reductase from a *Trifolium* species.

The specification describes such sequences from *T. repens* and the prior art describes chalone synthase-encoding nucleic acids from *T. subterraneum* (Howles et al, 1995, Plant Physiol. 107:1035-1036; Arioli et al, 1994, Gene 138:79-86) and chalone synthase- and dihydroflavonal 4-reductase- encoding nucleic acids from *T. repens* (Spangenberg et al, US Patent Application Publication 2005/0069884, filed 4 October 2002).

There are, however, at least 225 *Trifolium* species, including *T. acaule*, *T. affine*, *T. africanum*, *T. aintabense*, *T. albopurpureum*, *T. alexandrinum*, *T. alpestre*, *T. alpinum*, *T. amabile*, *T. ambiguum*, *T. amoenum*, *T. andersonii*, *T. andinum*, *T. andricum*, *T. angulatum*, *T.*

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*angustifolium*, *T. apertum*, *T. appendiculatum*, *T. argentinense*, *T. argutum*, *T. arvense*, *T. aureum*, *T. baccarinii*, *T. badium*, *T. balansae*, *T. barbeyi*, *T. barbigerrum*, *T. batmanicum*, *T. beckwithii*, *T. bejariense*, *T. berytheum*, *T. bifidum*, *T. bilineatum*, *T. billardierei*, *T. bocconeii*, *T. boissieri*, *T. bolanderi*, *T. brandegei*, *T. breweri*, *T. brutium*, *T. buckwestiorum*, *T. bullatum*, *T. burchellianum*, *T. calcaricum*, *T. calocephalum*, *T. campestre*, *T. canescens*, *T. carolinianum*, *T. caucasicum*, *T. caudatum*, *T. cernuum*, *T. cheranganiense*, *T. cherleri*, *T. chilaloense*, *T. chilense*, *T. ciliolatum*, *T. clusii*, *T. clypeatum*, *T. constantinopolitanum*, *T. cryptopodium*, *T. cyathiferum*, *T. dalmaticum*, *T. dasyphyllum*, *T. dasyurum*, *T. decorum*, *T. depauperatum*, *T. dichotomum*, *T. dichroanthum*, *T. diffusum*, *T. douglasii*, *T. dubium*, *T. echinatum*, *T. eriocephalum*, *T. eriosphaerum*, *T. erubescens*, *T. eximium*, *T. fragiferum*, *T. fucatum*, *T. gemellum*, *T. glanduliferum*, *T. globosum*, *T. glomeratum*, *T. gordejewii*, *T. gracilentum*, *T. grandiflorum*, *T. gymnocarpon*, *T. haussknechtii*, *T. haydenii*, *T. heldreichianum*, *T. hirtum*, *T. howellii*, *T. hybridum*, *T. incarnatum*, *T. isodon*, *T. israeliticum*, *T. isthmocarpum*, *T. jokerstii*, *T. kingii*, *T. lanceolatum*, *T. lappaceum*, *T. latifolium*, *T. latinum*, *T. leibergii*, *T. lemmonii*, *T. leucanthum*, *T. ligusticum*, *T. longidentatum*, *T. longipes*, *T. lucanicum*, *T. lugardii*, *T. lupinaster*, *T. macilentum*, *T. macraei*, *T. macrocephalum*, *T. masaiense*, *T. mattirolianum*, *T. medium*, *T. meduseum*, *T. michelianum*, *T. micranthum*, *T. microcephalum*, *T. microdon*, *T. miegeanum*, *T. monanthum*, *T. montanum*, *T. multinerve*, *T. mutabile*, *T. nanum*, *T. nigrescens*, *T. noricum*, *T. obscurum*, *T. obtusiflorum*, *T. occidentale*, *T. ochroleucum*, *T. oliganthum*, *T. ornithopodioides*, *T. owyheense*, *T. palaestinum*, *T. pallescens*, *T. pallidum*, *T. palmeri*, *T. pannonicum*, *T. parnassii*, *T. parryi*, *T. patens*, *T. patulum*, *T. pauciflorum*, *T. peruvianum*, *T. petitianum*, *T. philistaeum*, *T. phitosianum*, *T. phleoides*, *T. physanthum*, *T. physodes*, *T.*

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*pichisermollii*, *T. pignanii*, *T. pilulare*, *T. pinetorum*, *T. plebeium*, *T. plumosum*, *T. polymorphum*, *T. polyodon*, *T. polyphyllum*, *T. polystachyum*, *T. praetermissum*, *T. pratense*, *T. prophetarum*, *T. pseudostriatum*, *T. purpureum*, *T. purseglovei*, *T. quartinianum*, *T. reflexum*, *T. repens*, *T. resupinatum*, *T. retusum*, *T. riograndense*, *T. rubens*, *T. rueppellianum*, *T. rushyi*, *T. rytidosemium*, *T. salmoneum*, *T. scabrum*, *T. schimperii*, *T. scutatum*, *T. semipilosum*, *T. setiferum*, *T. sinense*, *T. sintenisii*, *T. somalense*, *T. spadiceum*, *T. spananthum*, *T. spumosum*, *T. squamosum*, *T. squarrosus*, *T. stellatum*, *T. steudneri*, *T. stoloniferum*, *T. stolzii*, *T. striatum*, *T. strictum*, *T. subterraneum*, *T. suffocatum*, *T. sylvaticum*, *T. tembense*, *T. thalii*, *T. thompsonii*, *T. tomentosum*, *T. triaristatum*, *T. trichocalyx*, *T. trichocephalum*, *T. trichopterum*, *T. tumens*, *T. uniflorum*, *T. usambarense*, *T. variegatum*, *T. vavilovii*, *T. velebiticum*, *T. velenovskyi*, *T. vernum*, *T. vesiculosum*, *T. virginicum*, *T. wentzelianum*, *T. wigginsii*, *T. willdenovii*, and *T. wormskioldii*.

Neither the specification nor the prior art describe chalone synthase-, dihydroflavonal 4-reductase- and leucoanthocyanidine reductase-encoding nucleic acids from a representative number of the full scope of *Trifolium* species.

The structural features that distinguish nucleic acids encoding a chalone synthase, dihydroflavonal 4-reductase and leucoanthocyanidine reductase from a *Trifolium* species from other chalone synthase-, dihydroflavonal 4-reductase- or leucoanthocyanidine reductase-encoding nucleic acids are not described in the specification.

Since the disclosure fails to describe the common attributes that identify members of the genus, and because the genus is highly variant, sequences from *T. repens* alone are insufficient to describe the claimed genus.

Further, the only leucoanthocyanidine reductase described in the art or the instant specification is from *T. repens*; the specification does not describe the necessary and sufficient structural elements of leucoanthocyanidine reductase.

The essential features of the claims 65-68 are constructs comprising antisense to a nucleic acid encoding SEQ ID NOs:2, 4, 6, or 8, antisense to a nucleic acid encoding SEQ ID NO:10, and, optionally, antisense to a nucleic acid encoding SEQ ID NOs:12, 14 or 16, variants have at least 90% identity to the "relevant part" of SEQ ID NOs:2, 4, 6, 8, 10, 12, 14 or 16 or sequences antisense to them, wherein the sequences modify the levels of chalone synthase, dihydroflavonol 4-reductase and leucoanthocyanidine reductase in a plant cell.

The structural features that distinguish those nucleic acids that modify the levels of chalone synthase, dihydroflavonol 4-reductase and leucoanthocyanidine reductase in a plant cell from those that do not are not described in the specification.

Hence, Applicant has not, in fact, described the constructs the full scope of the claims, and the specification fails to provide an adequate written description of the claimed invention.

Therefore, given the lack of written description in the specification with regard to the structural and functional characteristics of the claimed compositions, Applicant does not appear to have been in possession of the claimed genus at the time this application was filed.

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 62-76 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter that Applicant regards as the invention. Dependent claims are included in all rejections.

Claims 62, 65, and 70 are indefinite in their recitation of “dihydroflavonal 4-reductase (BAN)” as not all BAN proteins are dihydroflavonal 4-reductases (Dixon et al (US Patent Application Publication 2004/0093632, ¶206). Does Applicant mean only those dihydroflavonal 4-reductases that are encoded by a BAN gene?

Claim 64 lacks antecedent basis for the limitation “said ... fragmentsportions”.

Claim 65 is indefinite in its recitation of “having at least 90% identity to the relevant part of the sequences” in part (e). It is not clear to what the part is relevant or what part is relevant. For purposes of examination, “the relevant part” is assumed to be a dinucleotide.

Claim 69 is indefinite in its recitation of “the nucleic acid a construct”. Words appear to be missing from the claim.

Claim 71 and 75 are indefinite in their recitation of “of a the nucleic acid” in lines 4 and 3, respectively. Words appear to be missing from the claims.

### ***Claim Rejections - 35 USC § 102***

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.



8. Claims 65 and 67 are rejected under 35 U.S.C. 102(b) as being anticipated by Suzuki et al (2000, Mol. Breed. 6:239-246).

Suzuki et al teach *Torenia* plants that have been transformed with antisense constructs of chalone synthase and dihydroflavonol-4-reductase (pg 241, right column, ¶1). These sequences would have at least a portion that is 90% identity to "the relevant part" of 2, 4, 6, or 8 and at least 90% identity to the "relevant part" of SEQ ID NO:10, and are at least 60 nucleotides long.

***Claim Rejections - 35 USC § 103***

9. The following is a quotation of 35 U.S.C. 103(a), which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 62-76 are rejected under 35 U.S.C. 103(a) as being unpatentable over Spangenberg et al (US Patent Application Publication 2005/0069884, filed 4 October 2002).

The claims are drawn to constructs comprising a nucleic acid encoding SEQ ID NOs:2, 4, 6, or 8, a nucleic acid encoding SEQ ID NO:10, and, optionally, a nucleic acid encoding SEQ ID NOs:12, 14 or 16 or sequences antisense to those nucleic acids, or variants have at least 90% identity to the "relevant part" of those sequences and nucleic acids or constructs encoding a chalone synthase, dihydroflavonol 4-reductase and/or leucoanthocyanidine reductase from a *Trifolium* species.

Spangenberg et al teach a *T. repens* dihydroflavonol 4-reductase-encoding sequence (their SEQ ID NO:305) and *T. repens* chalone synthase-encoding sequences (their SEQ ID

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Nos:311, 313 and 315). Their SEQ ID NO:313 encodes a protein with 97.2% identity to the instant SEQ ID NO:2:

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US-10-491-823-314
; Sequence 314, Application US/10491823
; Publication No. US20050069884A1
; GENERAL INFORMATION:
; APPLICANT: Agriculture Victoria Services Pty Ltd
; APPLICANT: AgResearch Limited
; APPLICANT: SPANGENBERG, German
; APPLICANT: SAWBRIDGE, Timothy Ivor
; APPLICANT: ONG, Eng Kok
; APPLICANT: EMMERLING, Michael
; TITLE OF INVENTION: Manipulation of flavonoid biosynthesis in plants
; FILE REFERENCE: 4491-4003
; CURRENT APPLICATION NUMBER: US/10/491,823
; CURRENT FILING DATE: 2004-04-05
; PRIOR APPLICATION NUMBER: PR8113
; PRIOR FILING DATE: 2001-10-05
; PRIOR APPLICATION NUMBER: PCT/AU2002/001345
; PRIOR FILING DATE: 2002-10-04
; NUMBER OF SEQ ID NOS: 477
; SOFTWARE: PatentIn version 3.2
; SEQ ID NO 314
; LENGTH: 389
; TYPE: PRT
; ORGANISM: Trifolium repens
US-10-491-823-314

Query Match          97.2%; Score 1947; DB 5; Length 389;
Best Local Similarity 96.9%; Pred. No. 3.8e-185;
Matches 377; Conservative 6; Mismatches 6; Indels 0; Gaps 0;

Qy      1 MVSVAEIRKAQRAEGPATILAIGTANPPNRVEQSTYPDFYFKITNSEHKTELKEKFORMC 60
      |||:|||||:|||||:|||||:|||||:|||||:|||||:|||||:|||||:|||||:
Db      1 MVSVSEIRKAQRAEGPATILAIGTANPANRVDQSTYPDFYFKITNSEHKVLEKKEKFORMC 60

Qy      61 DKSMIKSRVMYLTEELKENPFLCEYMAPSLDARQDMVVVEVPRLGKEAAVKAKEWGQP 120
      |||:|||||:|||||:|||||:|||||:|||||:|||||:|||||:|||||:
Db      61 DKSMIKSRVMYLTEELKENPFLCEYMAPSLDARQDMVVVEVPRLGKEAAVKAKEWGQP 120

Qy      121 KSKITHLIFCTTSGVDMPGADYQLTKLLGLRPYVKRYMMYQQGCFAGGTVLRLAKDLAEN 180
      |||:|||||:|||||:|||||:|||||:|||||:|||||:|||||:|||||:
Db      121 KSKITHLIFCTTSGVDMPGADYQLTKLLGLRPYVKRYMMYQQGCFAGGTVLRLAKDLAEN 180

Qy      181 NKGARVLVVCSEVTAVTFRGPSDTHLDSL VGQALFGDGAALIVGSDVPPEIEKPIFEMV 240
      |||:|||||:|||||:|||||:|||||:|||||:|||||:|||||:|||||:
Db      181 NKGARVLVVCSEVTAVTFRGPSDTHLDSL VGQALFGDGAALIVGSDVPPEIEKPIFEMV 240

Qy      241 WTAQTIAPDSEGAIDGHLREAGLTFHLLKDVP GIVSKNINKALVEAFQPLGISDYSNIFW 300
      |||:|||||:|||||:|||||:|||||:|||||:|||||:|||||:|||||:
Db      241 WTAQTIAPDSEGAIDGHLREAGLTFHLLKDVP GIVSKNIDKALVEAFQPLNISDYSNIFW 300

Qy      301 IAHPGGGPAILDQVEQKLALKEPKMRATREVLSEYGNMSSACVLFILDEMRRKSAENGLKT 360
      |||:|||||:|||||:|||||:|||||:|||||:|||||:|||||:|||||:
Db      301 IAHPGGGPAILDQVEIKLGLKEPKMRATRDVLSEYGNMSSACVLFILDEMRRKSAENGLKT 360

Qy      361 TGEGLDWGVLF GFGPGLTIETVVLRSVAI 389

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|||||  
 Db 361 TGEGLDWGLVFGFGPLTIETVVLHSAI 389

Their SEQ ID NO:305 encodes a protein with 100% identity to the instant SEQ ID

NO:10:

US-10-491-823-306  
 ; Sequence 306, Application US/10491823  
 ; Publication No. US20050069884A1  
 ; GENERAL INFORMATION:  
 ; APPLICANT: Agriculture Victoria Services Pty Ltd  
 ; APPLICANT: AgResearch Limited  
 ; APPLICANT: SPANGENBERG, German  
 ; APPLICANT: SAWBRIDGE, Timothy Ivor  
 ; APPLICANT: ONG, Eng Kok  
 ; APPLICANT: EMMERLING, Michael  
 ; TITLE OF INVENTION: Manipulation of flavonoid biosynthesis in plants  
 ; FILE REFERENCE: 4491-4003  
 ; CURRENT APPLICATION NUMBER: US/10/491,823  
 ; CURRENT FILING DATE: 2004-04-05  
 ; PRIOR APPLICATION NUMBER: PR8113  
 ; PRIOR FILING DATE: 2001-10-05  
 ; PRIOR APPLICATION NUMBER: PCT/AU2002/001345  
 ; PRIOR FILING DATE: 2002-10-04  
 ; NUMBER OF SEQ ID NOS: 477  
 ; SOFTWARE: PatentIn version 3.2  
 ; SEQ ID NO 306  
 ; LENGTH: 338  
 ; TYPE: PRT  
 ; ORGANISM: Trifolium repens  
 US-10-491-823-306

Query Match 100.0%; Score 1728; DB 5; Length 338;  
 Best Local Similarity 100.0%; Pred. No. 1.7e-157;  
 Matches 338; Conservative 0; Mismatches 0; Indels 0; Gaps 0;

Qy	1	MASIKQIGNKKACVIGGTGFVASMLIKQLLEKGYAVNTTVRDPSPKKISHLVALQSLGE	60
Db	1	MASIKQIGNKKACVIGGTGFVASMLIKQLLEKGYAVNTTVRDPSPKKISHLVALQSLGE	60
Qy	61	LNLFRADLTVEEDFDAPIAGCELVFQLATPVNFASQDPENDMIKPAIKGVLNVLKAIARA	120
Db	61	LNLFRADLTVEEDFDAPIAGCELVFQLATPVNFASQDPENDMIKPAIKGVLNVLKAIARA	120
Qy	121	KEVKRVILTSSAAAVTINELKGTGHVMDETNWSDFEFLNTAKPPTWGPYPASKMLAEKAAW	180
Db	121	KEVKRVILTSSAAAVTINELKGTGHVMDETNWSDFEFLNTAKPPTWGPYPASKMLAEKAAW	180
Qy	181	KFAEENDIDLITVIPSLTTGFSPLTDPFPSSVGLAMSLITGNDFLINALKGMQFLSGSLSI	240
Db	181	KFAEENDIDLITVIPSLTTGFSPLTDPFPSSVGLAMSLITGNDFLINALKGMQFLSGSLSI	240
Qy	241	THVEDICRAHIFLAEKESASGRYICCAHNTSVPELAKFLNKRYQYKVPTEFDDCPSKAK	300
Db	241	THVEDICRAHIFLAEKESASGRYICCAHNTSVPELAKFLNKRYQYKVPTEFDDCPSKAK	300
Qy	301	LIISSEKLIKEGSPFKHGIETFDQTVVEYFKTKGALKN	338

Db 301 LIISSEKLIKEGFSFKHGIATFDQTVEYFKTKGALKN 338

Spangenberg et al disclose Arabidopsis plants transformed with the nucleic acids (¶302-321). Spangenberg et al also disclose nucleic acids encoding a fragment of a leucoanthocyanidine reductase from *T. repens* (¶24).

Spangenberg et al do not teach constructs encoding both *T. repens* dihydroflavonal 4-reductase-encoding sequence and *T. repens* chalone synthase. Spangenberg et al also do not teach a nucleic acid encoding a full-length leucoanthocyanidine reductase with 90% identity to SEQ ID NO:14 or one from *T. repens*.

At the time the invention was made, it would have been obvious to one of ordinary skill in the art to use the nucleic acids encoding a fragment of a leucoanthocyanidine reductase from *T. repens* taught by Spangenberg et al, to isolate full-length nucleic acids encoding a fragment of a leucoanthocyanidine reductase from *T. repens*. One of ordinary skill in the art would have been motivated to do so because leucoanthocyanidine reductase is an important enzyme that catalyzes an early step in condensed tannin biosynthesis (¶7).

At the time the invention was made, it would have been obvious to one of ordinary skill in the art to modify the method of transforming plants with *T. repens* dihydroflavonal 4-reductase-encoding sequence and *T. repens* chalone synthase as taught by Spangenberg et al, to put both nucleic acids on the same construct. One of ordinary skill in the art would have been motivated to do so because expressing the enzymes on one construct rather than two is an obvious design choice. Further, it would have been obvious to one of ordinary skill in the art to include the leucoanthocyanidine reductase-encoding nucleic acids in the constructs, given the

importance of this enzyme in condensed tannin biosynthesis (§7). Such expression would modify forage quality and condensed tannin biosynthesis.

11. Claims 62-76 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dixon et al (US Patent Application Publication 2004/0093632, filed 28 June 2002) in view of Arioli et al (1994, Gene 138:79-86).

The claims are drawn to constructs comprising a nucleic acid encoding SEQ ID NOs:2 or antisense to it or encoding a *T. repens* chalone synthase, a nucleic acid encoding SEQ ID NO:10 or antisense to it or encoding a *T. repens* dihydroflavonal 4-reductase and a nucleic acid encoding SEQ ID NO:14 or antisense to it or encoding a *T. repens* leucoanthocyanidine reductase. The claims are also drawn to plants transformed with the nucleic acid and methods comprising introducing the nucleic acids into plants.

Dixon et al teach a nucleic acid encoding the leucoanthocyanidine reductase from *Arabidopsis thaliana* and *Medicago truncatula* and plants transformed with them (§6, 8-9, 183-188, 190, 193, 198-202). Dixon et al teach a nucleic acid encoding dihydroflavonal 4-reductase from *M. truncatula* and plants transformed with them (§62, 206). Dixon et al also teach plants comprising a nucleic acid encoding the leucoanthocyanidine reductase and a nucleic acid encoding chalone synthase (§10; claim 17).

Dixon et al does not teach a nucleic acid encoding dihydroflavonal 4-reductase, leucoanthocyanidine reductase or chalone synthase from *T. repens*.

Arioli et al teach nucleic acids encoding *T. subterraneum* chalone synthases (Fig. 2).

At the time the invention was made, it would have been obvious to one of ordinary skill in the art to isolate nucleic acids encoding chalone synthase, dihydroflavonal 4-reductase, and

leucoanthocyanidine reductase from *T. repens* using the methods and nucleic acids taught by Dixon et al and Arioli et al, and express them in plants. One of ordinary skill in the art would have been motivated to do so because white clover is an important forage crop that is low in condensed tannins (Dixon et al ¶51) and because expression of the all the enzymes is suggested by Dixon et al (¶63-64).

### ***Conclusion***

12. No claim is allowed.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anne R. Kubelik, Ph.D., whose telephone number is (571) 272-0801. The examiner can normally be reached Monday through Friday, 8:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Anne Marie Grunberg, can be reached at (571) 272-0975.

The central fax number for official correspondence is (571) 273-8300.

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February 19, 2010

/Anne R Kubelik/  
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